

# Optimal Stochastic Resetting Strategies

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Resetting has been shown to reduce the completion time for a stochastic process, such as the first passage time for a diffusive searcher to find a target. The idea is resetting cuts off errant trajectories that would otherwise have a long time tail to completion. A resetting strategy may be defined by the distribution of waiting times between resets. Previously, it had been shown that deterministic resetting process with a constant time period, referred to as sharp restart, can minimize the mean first passage time to a fixed target. In this talk we consider the more realistic problem of a target positioned at a random distance,  $R$ , from the resetting site, selected from a given target distribution  $P(R)$ . We introduce the notion of a conjugate target distribution to a given waiting time distribution. The conjugate target distribution, is that for which the given waiting time distribution extremizes the mean time to locate the target i.e. for the conjugate target distribution, the given waiting time distribution is an optimal resetting strategy. In the case of diffusion, we present an explicit expression for the conjugate target distribution to any given waiting time distribution. Importantly, our results show that stochastic resetting prevails over sharp restart for target distributions with exponential or heavier tails. The explanation is that a broader target distribution implies less information of the target's whereabouts and a broader distribution of reset times becomes advantageous. We show that our results hold in arbitrary spatial dimension  $d < 4$ .

References:

- [1] M. R. Evans and S Ray Stochastic resetting prevails over sharp restart for broad target distributions. Physical Review Letters 134, 247102 (2025)
- [2] M. R. Evans, S. N. Majumdar and G. Schehr Stochastic resetting and applications J. Phys. A: Mathematical and Theoretical 53, 19300 (2020)